

May 22, 1923.

A. V. P. M. BERTHIER

1,456,482

FIREARM

Filed Nov. 20, 1918

5 Sheets-Sheet 1

Fig. 1.

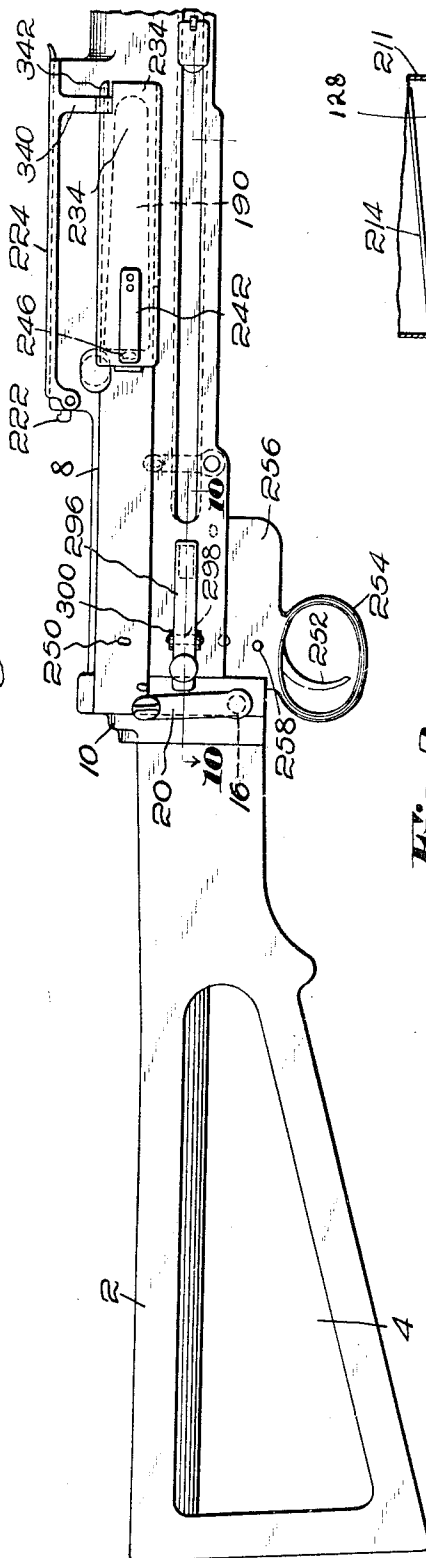
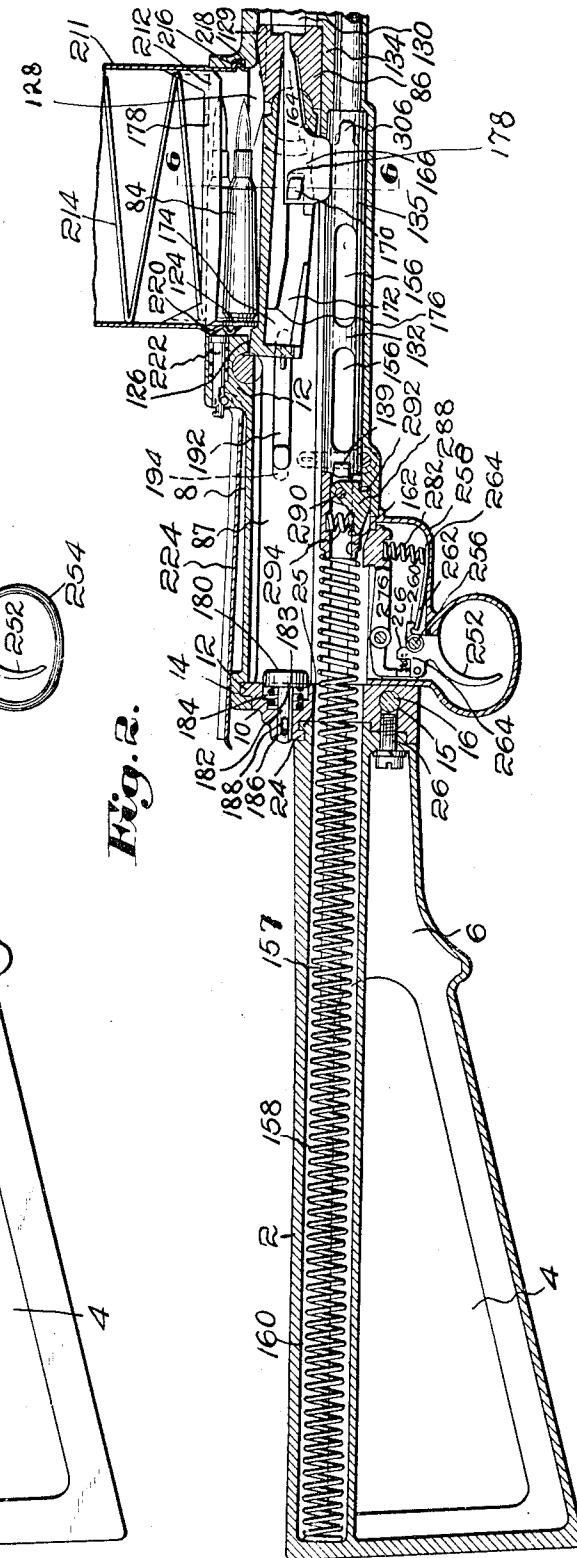


Fig. 2.



Inventor:
Andre V. P. M. Berthier,
by Emery, Booth, Janney & Varney Attys.

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5 Sheets-Sheet 2

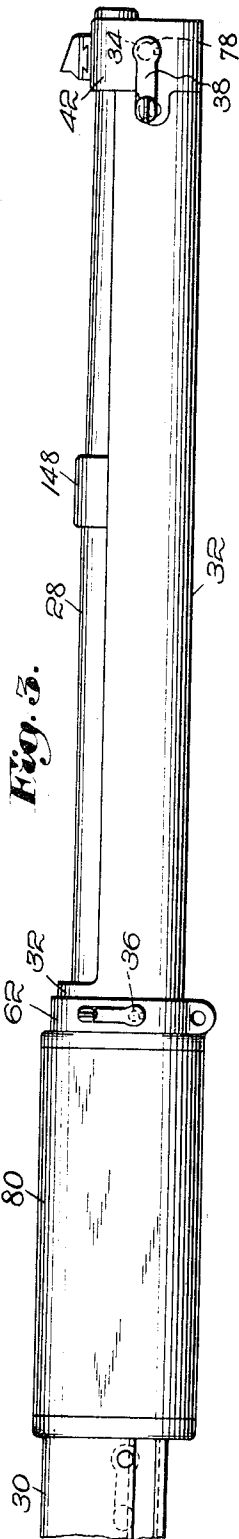


Fig. 3.



Fig. 5.

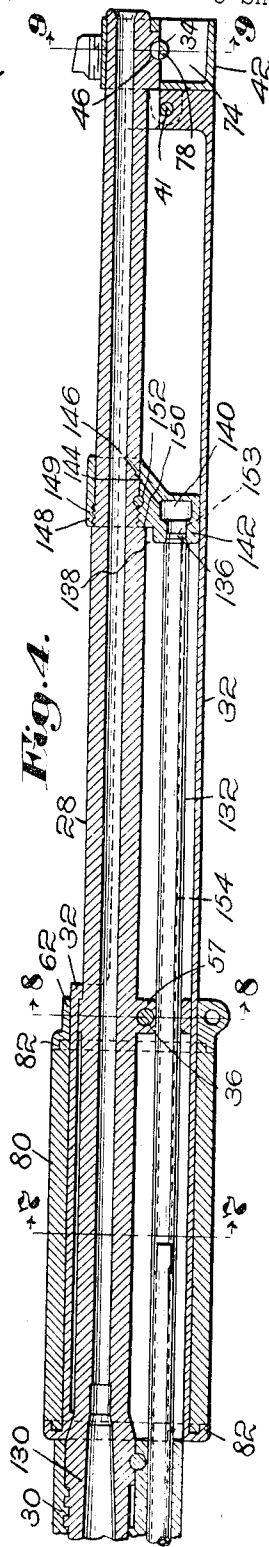


Fig. 4.

Inventor:
Andre V. P. M. Berthier.
by Emery, Booth, Janney & Varney Attys.

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5 Sheets-Sheet 3

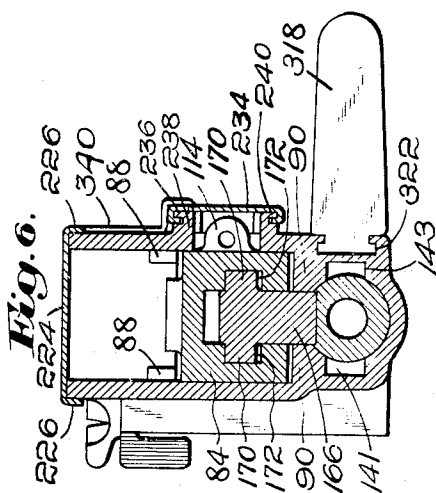


Fig. 7.

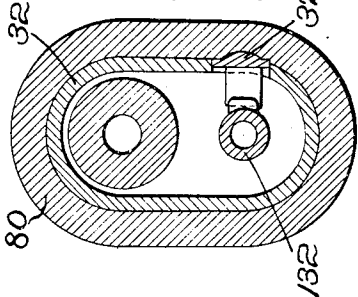


Fig. 8.

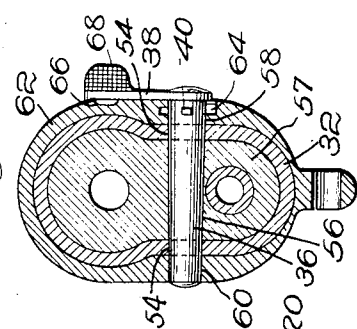


Fig. 9.

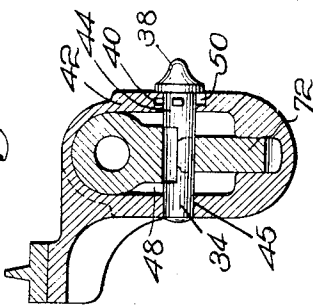
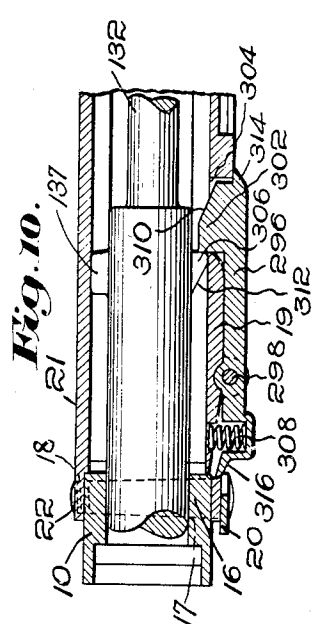


Fig. 10.

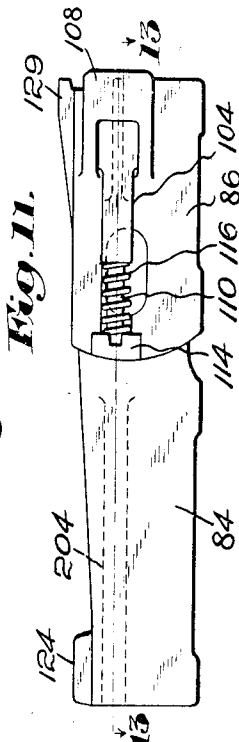


Fig. 11.

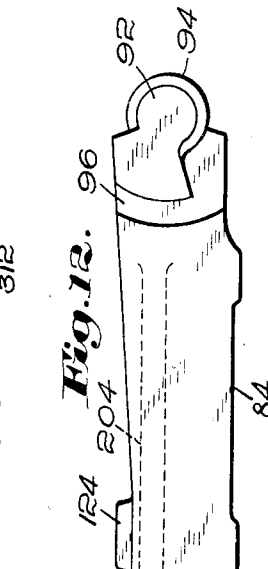


Fig. 12.

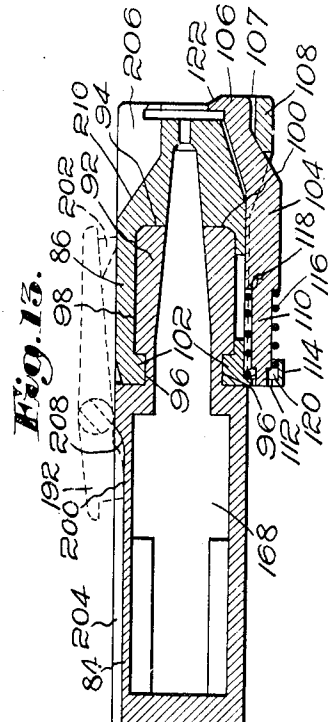


Fig. 13.

Inventor:
Andre' V. P. M. Berthier.
by Emery, Booth, Janney & Varney
Attys

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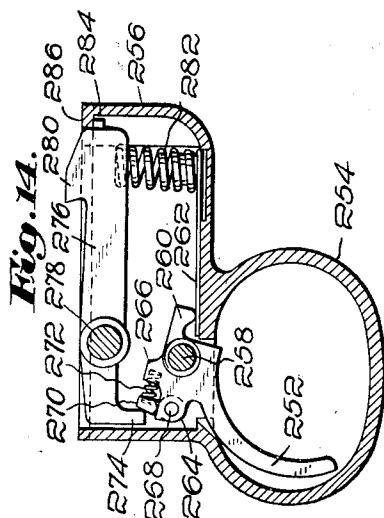
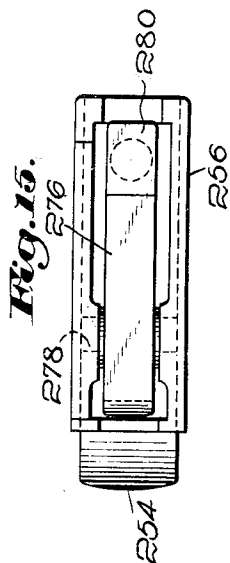
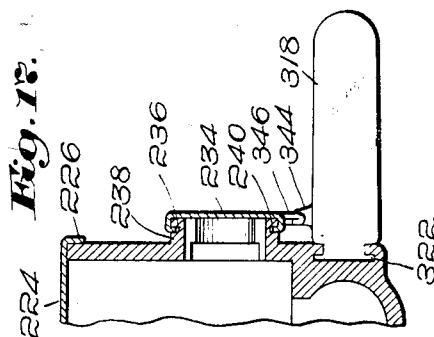
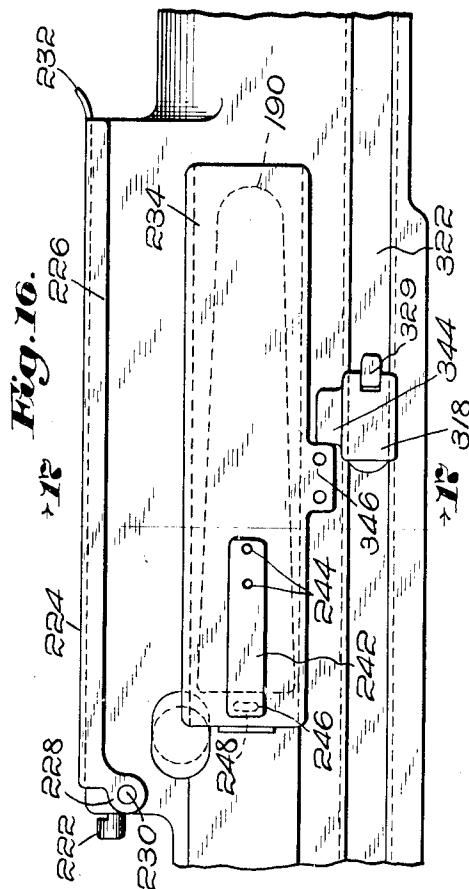
A. V. P. M. BERTHIER

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5 Sheets-Sheet 4



Inventor:
Andre' V. P. M. Berthier,
by *Emery, Booth, Janney & Varney,*
Attys

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A. V. P. M. BERTHIER

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Filed Nov. 20, 1918

5 Sheets-Sheet 5

Fig. 18.

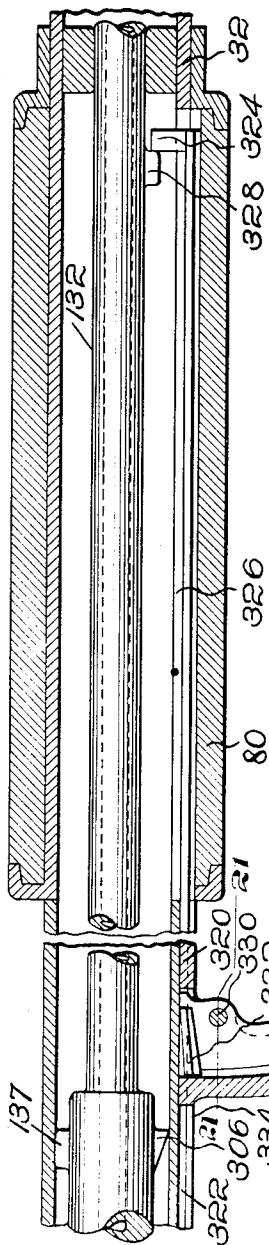


Fig. 22.

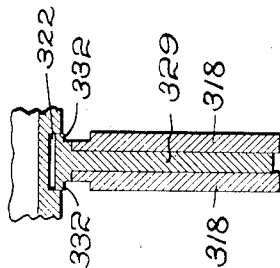


Fig. 23.

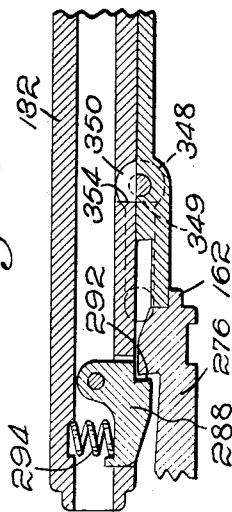


Fig. 20.

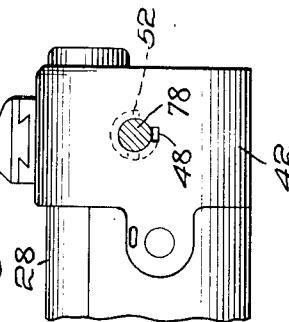


Fig. 19.

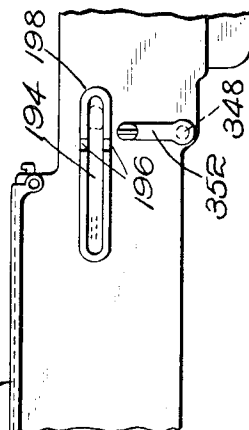
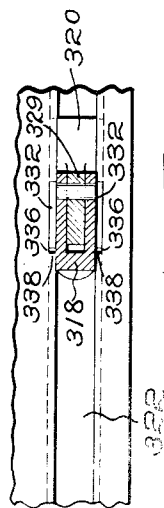


Fig. 21.



Inventor:
Andre' V. P. M. Berthier,
by Emery, Booth, Jarney & Varney,
Atty.

UNITED STATES PATENT OFFICE.

ANDRÉ VIRGILE PAUL MARIE BERTHIER, OF NEUILLY-SUR-SEINE, FRANCE, ASSIGNOR
TO UNITED STATES MACHINE GUN COMPANY, OF BOSTON, MASSACHUSETTS, A
CORPORATION OF MASSACHUSETTS.

FIREARM.

Application filed November 20, 1918. Serial No. 263,277.

To all whom it may concern:

Be it known that I, ANDRÉ VIRGILE PAUL MARIE BERTHIER, a citizen of the Republic of France, and a resident of Neuilly-sur-Seine, in the French Republic (whose post-office address is 15 bis Rue d'Orléans, Neuilly-sur-Seine, France), have invented an Improvement in Firearms, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to firearms in general and more particularly to rifles.

The invention has for its object, among other things, to provide a rifle operated by the explosion, that may be used either for semi-automatic or automatic firing, and which shall be simple in construction, efficient, accurate and reliable in operation and light in weight while possessing in all its parts the strength necessary to withstand the hardest possible usage.

These and other features of the invention will be clearly understood from the following description, taken in connection with the accompanying drawings, of one preferred embodiment of the invention herein shown and described for illustrative purposes, it being understood that the invention in its true scope is more particularly set forth in the claims.

In the drawings:

Fig. 1 is a side elevation of the rear half of a rifle of the general type described, embodying one form of the invention;

Fig. 2 is a vertical longitudinal median section of the rear half of the rifle represented in Fig. 1;

Fig. 3 is a side elevation of the front half of the rifle illustrated in Fig. 1;

Fig. 4 is a vertical longitudinal median section of the front half of the rifle represented in Fig. 3;

Fig. 5 is a side elevation of a bayonet for use with the rifle embodying the present invention;

Fig. 6 is an enlarged vertical cross section on lines 6—6 of Fig. 2;

Fig. 7 is an enlarged vertical cross section on line 7—7 of Fig. 4;

Fig. 8 is an enlarged vertical cross section on line 8—8 of Fig. 4;

Fig. 9 is an enlarged vertical cross section on line 9—9 of Fig. 4;

Fig. 10 is an enlarged horizontal longitudinal section on line 10—10 of Fig. 1, the gas piston being in its rear position;

Fig. 11 is an enlarged side elevation of the breech block and of the extractor carried thereby;

Fig. 12 is a side elevation of the rear part of the breech block shown in Fig. 11;

Fig. 13 is a horizontal longitudinal section of the breech block shown in Fig. 11, and illustrating the ejector in dotted lines, with which it cooperates;

Fig. 14 is an enlarged side elevation partly in section of the trigger mechanism and sear;

Fig. 15 is a top plan view of the parts shown in Fig. 14;

Fig. 16 is a side elevation of the fore part of the receiver illustrating a modified form of means for assuring that the opening through which the exploded cartridge-shells are ejected shall be open before the rifle can be fired.

Fig. 17 is a vertical cross section on line 17—17 of Fig. 16;

Fig. 18 is a longitudinal horizontal section partly in elevation, showing more particularly the hand-cocking means and its locking mechanism;

Fig. 19 is a side elevation of a part of the receiver showing the boss in which is mounted the ejector;

Fig. 20 is a side elevation of the muzzle part of the gun, showing the locking pin in section and the recess in dotted lines with which the lug on said pin cooperates.

Figs. 21 and 22 are sectional details of the cocking handle mechanism;

Fig. 23 shows the safety catch in operative position.

One of the objects of the present invention being to provide a rifle that shall be as light as possible consistent with strength, the butt and stock are herein made of some material which, while light, is strong enough to enable the parts to be made less bulky and of less weight than would be required were they made of wood, as heretofore. Aluminum is eminently adapted for this purpose and in the illustrative embodiment of the invention here-

in shown, the stock and butt are made of that metal. This metal also possesses a high coefficient of thermal conductivity and a stock of this metal therefore contributes to the more rapid cooling of the arm.

Referring to the drawings and more particularly to Figs. 1 and 2, the butt 2 is shown as recessed at 4 and hollow at 6 to reduce its weight as much as possible. The receiver is shown at 8 and the rear wall 10 of the receiver is preferably made removable to give access to the parts contained in the receiver chamber. To this end the rear wall 10 of the receiver is provided with a rib 12 (Fig. 2) adapted to engage and fit within a slot 14 provided in the top wall of the receiver at its rear, and adjacent its base the rear wall of the receiver is provided with a perforation 15 to receive a pin 16 that also extends through similar perforations 17 and 18 provided in the side walls 19 and 21 of the receiver embracing said rear wall at its ends, said pin being provided at one end with a handle 20 and at its other end with a screw threaded portion 22 for screw threaded engagement with the screw threaded perforation 18 in the side wall 21 of the receiver.

The butt 2 is removably secured to the rear wall 10 of the receiver, Fig. 2, by a rib 24 on the front end of said butt which engages a transverse slot 25 provided in said rear wall, and by a screw bolt 26 extending through the front part of said butt from the inner end of the hollow portion 6 thereof and having screw threaded connection with a screw threaded hole in the rear wall of the receiver.

The barrel 28 has screw threaded connection at 30 with the receiver and has secured thereto the stock 32. As shown in Figs. 3 and 4 the stock surrounds the barrel for a distance of about one third of its length from the receiver forward, but leaves substantially the upper half of the barrel exposed for the remainder of its length. The stock may be secured to the barrel in any suitable manner and by any suitable means, but the present invention contemplates the use of securing means that will furnish a perfectly rigid and secure connection between the barrel and the stock and at the same time will permit the parts to be rapidly taken down should occasion require it. To this end I preferably use two pins 34 and 36, each provided with a handle 38 and a lug 40.

To the forward end of the stock 32 is rigidly secured by means of a bolt or pin 41 a muzzle piece 42, preferably of steel, Figs. 3, 4 and 9, said muzzle piece surrounding the muzzle part of the barrel and being provided in its opposite walls with registering perforations 44, 45, which, when said muzzle piece is in place on the barrel

also register with a semi-cylindrical perforation 46, Fig. 4 provided in a downwardly projecting part 48 of the barrel. The perforation 44 in the right wall of the muzzle piece 42, see Fig. 9, is provided with a downward extension 50, which latter communicates with a recess 52 extending around within said wall of the muzzle piece throughout an angle of substantially 270°, Fig. 20. When the pin 34 is inserted into the perforations 44, 45 and 46, as shown in Fig. 9 the lug 40 on said pin enters the downward extension 50 of the perforation 44, and then when the pin 34 is inserted as far as it will go, by turning said pin about 90°, said lug 40 will enter the recess 52, thus locking the pin 34 in place and rigidly securing the stock at its forward end to the barrel.

The pin 36 secures the rear portion of the stock to the barrel in substantially the same manner, Figs. 3, 4 and 8, just described in the case of the pin 34, said pin 36 extending through registering perforations 54, 54 in the opposite walls of the stock through a perforation 56, registering with the perforations 54, 54 and provided in a downwardly extending boss 57 on the barrel and through two registering perforations 58 and 60 provided in the opposite walls of a collar 62, preferably of aluminum, and which fits about the stock, as shown in said Figs. 3, 4 and 8. The perforation 58 in the right wall, see Fig. 8, of the collar 62 is provided with a downwardly extending extension 64, through which the lug 40 in the pin 36 enters as the pin is inserted into the perforations 54, 54, 56, 58 and 60, said extension 64 communicating with a recess extending around within the right wall referring to Fig. 8, of the collar 62 throughout an angle of substantially 270°, so that by giving the pin 36 substantially a quarter turn when it has been inserted in place, the stock, barrel and collar 62 will be firmly locked together.

Upon its under side the handle 38 of the pin 36 is preferably provided with a rounded lug 66 adapted to snap into a suitable recess 68, provided in the collar 62, when said pin is in locking position, to prevent accidental rotation of the pin. The handle 38 of the pin 34 and the muzzle piece 42 will preferably be provided, respectively, with a similar lug and recess, not shown, for the same purpose.

The present invention contemplates the provision of a handleless bayonet, substantially as illustrated in Fig. 5, said bayonet comprising a blade 70 and short shank 72 in lieu of a handle, said shank being adapted to be inserted in a longitudinal socket 74 provided in the muzzle piece 52 and within which it fits. The pin 34 also serves removably to secure the bayonet in place in its

socket 74, said pin, when in locking position engaging one of the two recesses 76, 76 provided in the opposite edges of the bayonet shank 72, according to which edge of said shank is inserted in the socket uppermost, while when said pin is in unlocking position, a recess 78 therein comes opposite the recess 76 in the bayonet shank, so that the bayonet can then be readily inserted or withdrawn.

The rifle is provided, as usual, with a guard for the hand of the rifleman, of some material having a low coefficient of thermal conductivity. While any suitable material may be used, herein the guard 80 is of wood. The guard is in the form of a sleeve which fits snugly about the rear portion of the stock, as shown in Fig. 4, and is bound at its edges with metal, preferably aluminum, as shown at 82, 82. It is held in place between the abutting inner edge of the collar 62 and the abutting front edge of the wall of the receiver 8. By removing the collar 62 the guard 80 can be readily removed and replaced.

The breech block herein comprises two parts, a rear part or bolt 84 and a front part or head 86. The breech block, in its operation, slides back and forth in the receiver chamber 87, the head being confined to a rectilinear movement by guides 88, 88 and 90, 90, while the rear part is adapted to move vertically, to effect the locking and unlocking of the breech. In order to permit this movement of the rear part 84 of the breech block relatively to the head 86, these two parts are herein connected as follows.

Referring more particularly to Figs. 11, 12 and 13, the rear part 84 of the breech block is provided at its forward end with a forwardly projecting boss 92 having plane sides joined by a surface 94 curved in the arc of a circle. Back of this boss 92 said rear part 84 of the breech block is provided upon each side with a groove 96, curved in the arc of a circle concentric with that of the curved surface 94. The breech block head 86 is provided at its rear end with a recess 98 to receive the boss 92, said recess having plane side walls and a curved front wall 100 to fit the plane side surfaces and curved front surface respectively of said boss 92, the side walls of said recess being also provided at the rear with inwardly projecting ribs 102, 102, of the same curvature as the grooves 96, 96 and adapted to fit within the latter. The described construction furnishes a very simple and perfectly secure connection between the two parts of the breech block, while permitting the required vertical movement of the rear part relatively to the head, and also rapid separation of the two parts 84 and 86 or the quick replacement of either in case of breakage or for any other cause. This is an important

feature, as sometimes owing to breakage in use, these parts have to be replaced under fire and difficult conditions.

The breech block head 86 carriage at one side the extractor 104, Figs. 11 and 13, the front end of which terminates in the hook 106, extending through an opening 107 of suitable shape provided in a lateral boss 108 on said head 86, and its shank 110 engaging an opening 112 provided in another lateral boss 114 on said head. A helical spring 116 surrounds the shank 110 of the extractor, one end of said spring bearing against a shoulder 118 at the junction of said shank with the extractor proper and the other end of said spring bearing against the bottom of a recess 120 provided in said boss 114.

When the head 86 of the breech block, in the forward movement of the latter, drives home a cartridge into the cartridge chamber of the rifle, the inclined surface 122 on the hooked end of the extractor meets the rear face of the cartridge near the rim thereof, thus causing said extractor to yield rearwardly against the action of the spring 116 and its head 106 to swing outwardly and then snap or hook over the cartridge rim, so that when the breech bolt is next moved rearwardly, the extractor will extract the exploded shell, as will be readily understood by those skilled in the art.

At its top, adjacent its rear end, the rear part 84 of the breech bolt carries the locking lug 124, which, when the breech bolt is driven forward, enters a recess 126 in the top wall of the receiver at the rear of the loading chamber 128 and locks the breech block in its forward position. At its forward end, the breech block head 86 is provided with means for feeding a cartridge from the magazine to the cartridge chamber, said means herein consisting of a wedge shaped projection 129, which, in the forward movement of the breech block, engages the rear end of the lowermost cartridge in the magazine and feeds it into the cartridge chamber.

As already stated, the rifle embodying the present invention is operated by the explosion of the charge. In the embodiment of the invention herein illustrated, this is effected by causing a portion of the explosion gases to actuate an actuator, by which the rifle mechanism is operated. Herein the actuator consists of a piston 132, which is mounted for sliding movement within the stock 32 under the barrel and within the lower part of the receiver. This piston is guided by the sliding fit of the forward portion in an opening in the downwardly projecting part 57 of the barrel and an opening in the wall 134 under the receiver. Intermediate its two ends said piston is provided with an enlarged portion 135, which carries two guiding lugs 137 and 139, one near the forward end of

said enlarged portion and the other near its rear end, see Figs. 10 and 2, respectively, which slide in guideways 141 and 143, Fig. 6, provided in the walls of the lower part of the receiver and in the walls of the recess 160 in the butt. In its forward position, Fig. 4, the forward end 136 of the piston fits within a cylindrical passage 138 leading to a gas chamber 140 provided in a block 142 and communicating with the bore of the barrel 28 by a passage 144 provided in said block and a passage 146 registering therewith and extending through the lower wall of the barrel and into the bore thereof. The block 142 is provided with an integral sleeve portion 148 which can be slid over the barrel which it fits, said sleeve having screw threaded connection at 149 with said barrel and abutting against a shoulder 150 on the barrel. The block is removably secured to the barrel by a locking pin 152 fitting within a perforation correspondingly shaped in cross section and which extends through the opposite walls of the block and has its central portion formed partly in the underside of the barrel and partly in the lower wall of the sleeve portion 148. This pin may have a handle at one end and a screw threaded portion at the other end to engage a screw threaded portion provided in the corresponding wall of the block 142; that is to say said pin may be similar in all respects in construction and operation to the locking pin 16 previously described. At each discharge a portion of the explosion bases penetrates to the chamber 140 from the barrel bore through the passages 144, 146, and acting upon the front end of the piston 132 drives it rearwardly. It has been found advisable to use for this purpose only a portion of the gases penetrating to the chamber 140, and to this end it has heretofore been customary to provide a vent in the wall of said chamber, leading directly to atmosphere. This gave opportunity for dirt, grit and other foreign matter to penetrate to said chamber and from there to enter the bore of the rifle and other spaces leading from about the piston, and the vent itself was also liable to become clogged. All this might be highly injurious to the life and proper functioning of the rifle, as will be readily understood by those skilled in the art. In accordance with the present invention, these difficulties are overcome by placing the vent 153 in the front end of the piston, said vent communicating with the interior of the piston, which is made hollow for that purpose, as shown at 154. The hollow piston also has the further advantage of lessening the total weight of the rifle. To the latter end, Fig. 2, the walls of the piston may also be provided with one or more cut away portions 156, 156.

The forward movement of the piston is

effected as heretofore by a spring, which surrounds the shank 157 of the piston, but herein, Fig. 2, said spring 158 is lodged in a recess 160 provided in the stock instead of under the receiver or barrel as heretofore, thus saving considerable space. The spring abuts with one end against the bottom of said recess 160 and with its other end against a shouldered portion 162 of the piston.

The firing pin 164 is preferably formed integral with a block 166, Figs. 2 and 6, which latter is carried by the piston 132, with which it may be formed integral or to which it may be rigidly secured in any suitable manner.

The breech block is recessed interiorly at 168, as shown in Fig. 13, said recess being open at the bottom, and when the gun is assembled, the block 166 with its firing pin 164 is received in said interior recess 168 of the breech block, in which it can move back and forth lengthwise of the latter. The forward portion of said recess 168 extends to the forward end of the breech block head 86 and is shaped to correspond approximately to the shape of the firing pin 164, the point of the latter projecting through an opening in the front end of said breech block head 86 to explode the cartridge when the breech block and piston are in their forward position. Two cam lugs 170, 170, Figs. 2 and 6, are provided one upon each side of the block 166, said lugs being adapted to travel in guideways 172, 172 provided in the lateral walls of the rear part 84 of the breech block. These guideways are inclined upwardly at their rear portions, and at their upper rear ends they are each provided with a recess 174 and a shoulder 176, one of which recesses and shoulders is shown in Fig. 2. It will be apparent that as the block 166 moves backward and forward in the breech block, the lugs 170, 170 cooperating with the guideways 172, 172 will move the rear part 84 of the breech block down and up. The upper forward corners 178, 178 of the lugs 170, 170 are rounded or bevelled, as shown in Fig. 2, and are adapted to cooperate with the shoulders 176, 176, for a purpose hereinafter more fully described.

In order to cushion the rear stroke of the breech block, a buffer 180, Fig. 2, is preferably provided in the rear wall 10 of the receiver chamber, said buffer herein having a stem 182 adapted to slide in a perforation 183 provided in said rear wall and surrounded by a helical spring 184 which yieldingly maintains said buffer in its forward position. A pin 186, mounted at the ends in the walls of the perforation 183, extends through a longitudinal slot 188 provided in said stem 182 to limit the forward movement of the buffer.

In the embodiment of the invention herein shown the exploded cartridges will preferably be ejected through an opening 190, shown in dotted lines in Figs. 1 and 16 and provided in the right-hand lateral wall of the receiver. The ejector may be of any usual and suitable construction, said ejector herein consisting of a lever 192, see dotted lines in Fig. 13, and full lines in Fig. 2, which operates in an opening 194 provided in the wall of the receiver opposite to that in which is provided the opening 190 through which the exploded shells are ejected. Said ejector 192 is provided with trunnions that are adapted to turn in openings 196, 196, Fig. 19, provided in the flange 198 projecting outwardly around the edge of said opening 194. Said ejector 192 is provided at its rear end upon its inner surface with a cam projection 200 and at its forward end upon its inner surface with a tooth 202. When the breech block is in its forward position, the ejector 192 occupies the position shown in Fig. 13, with the cam projection 200 thereon engaging a cam groove 204 provided in the adjacent side of the rear part 84 of the breech block. At its front end the breech block head 86 is provided upon that side toward the ejector, with a recess 206 upon the same level with the tooth 202 of the ejector. The cam groove 204 at its inner end is curved outwardly, as shown at 208 in Fig. 13, and when the breech block and extractor move backwardly, carrying with them an exploded shell, said outwardly curved portion 208 of the cam groove 204 in the breech block meets the cam projection 200 on the ejector at the time when the recess 206 arrives opposite the tooth 202 of said ejector, in the continued rearward movement of the breech block, the rear end of the ejector will thus be swung outwardly and its front end inwardly, thus causing the tooth 202 to enter the recess 206 in the breech block head, where, in the continued rearward movement of the breech block, said tooth meets the rear face of the exploded shell and swings the latter toward the ejection opening 190, finally freeing the rear end of the shell from the extractor 104 and ejecting the shell from the gun through the ejection opening 190. As the breech block moves forward again, the tooth 202 on the ejector meets the inclined surface 210 in the recess 206 of the breech block head about the time that the cam projection 200 of the ejector is free from the surface 208 of the cam groove 204, thus swinging the front end of the ejector outwardly and its rear end inwardly into its normal position.

The magazine is of well known construction and need not be described in detail. Briefly, said magazine consists of a sheet metal receptacle 211 only the lower portion of which is shown in Fig. 2, said receptacle

being closed at the top and open at the bottom and of a height sufficient to receive the number of cartridges desired. Its width and thickness are slightly greater than the length and thickness, respectively, of a cartridge. The cartridges are inserted in said magazine, one above the other, in staggered and slightly overlapping relation, and are pressed toward the open end of the magazine by a spring pressed follower 212 acted upon by the spring 214. The lower end of the magazine fits within a correspondingly shaped opening provided in the top of the receiver, as shown in Fig. 2, a lug 216 upon the front of the lower end of said magazine engaging a recess 218 provided in the front wall of the receiver and a recess 220 near the bottom of the rear face of said magazine being engaged by the wedge-shaped front end of a spring-pressed pin 222 mounted in the rear wall 12 of the receiver, whereby the magazine will be firmly held in operative position.

It is preferable that the opening provided in the receiver for the reception of the lower end of the magazine be protected against the entrance of dirt, sand or other foreign matter, when the gun is not in use or the magazine is not in place therein, and the present invention contemplates the provision of means to that end. Herein said means consists of a cover plate 224 extending throughout the length of said opening and having lateral downwardly extended flanges 226 embracing the receiver upon both sides of said opening. Figs. 1, 6, 16 and 17, and terminating at their rear ends in ears 228, pivoted to studs 230 projecting from the sides of the receiver, only one of said ears and studs being shown in Fig. 16. When the magazine is not in place, said plate 224 can be swung downwardly into the position shown in Fig. 16, in which position it completely closes the opening in the top of the receiver, the flanges 226 embracing the receiver with a sufficiently close fit to exclude all dust and dirt and to secure the plate 224 against accidental opening. When the gun is to be used or the magazine inserted, the plate 224 will be swung upwardly and rearwardly into the position shown in Fig. 2. To facilitate this, it may be provided at its forward end with a projecting lip 232.

It is also preferable that the ejection opening 190 be closed when the gun is not in use to prevent the entrance of dirt or other foreign matter, and the present invention contemplates the provision of means to that end. The ejection opening 190 is herein surrounded by an outwardly projecting flange 238, Fig. 6, and said means herein consist of a slide plate 234 somewhat longer than said opening and having its upper edge turned inwardly and downwardly to engage a groove 236 provided in that part

of the flange 238 that extends along the top of said opening. The lower edge of said plate 234 is turned inwardly and upwardly to engage a groove 240 provided in that part of the flange 238 that extends along the lower edge of said opening 190. The plate 234 can thus be slid forwardly into the position shown in Fig. 16 to close said opening or rearwardly to open or uncover the same. In its closed position the plate 234 fits tightly against the edge of the flange 238, and as the latter extends completely around said opening the latter will be protected against the entrance of any foreign matter. To secure said plate 234 against accidental displacement when it is in its closed or open position, said plate is provided with a spring member 242 secured at one end to the outside of said plate by rivets 244, or in any other suitable manner, and provided upon its inner surface at its free end with a projection 246 that projects through an opening provided in said plate 234. In the closed position of said plate 234, this projection engages a notch 248 provided in the side of the receiver, while when said plate is withdrawn from said opening 190, said projection 246 engages a notch 250 in the wall of said receiver, see Fig. 1.

Referring more particularly to Figs. 1, 2 and 14, the trigger is shown at 252 and is protected by the usual guard 254 which may be integral with the trigger mechanism casing 256. The trigger is pivoted upon a pin 258 having its ends mounted in the lateral walls of said trigger mechanism casing 256 and adjacent said pivot the trigger is provided with a tooth 260 which is acted upon by one end of a leaf spring 262, the other end of which is secured at 264 to the lower wall of said casing 256. The trigger is also provided with a split ear 264 and a boss 266 extending substantially at right angles to said ear, as shown more clearly in Fig. 14. In the split ear 264 is pivotally mounted, at 268, a pawl 270 which is acted upon by one end of a spring 272, the other end of which is received in a recess provided in said boss 266, the action of said spring being to maintain said pawl normally at right angles to the ear 264, as shown in Fig. 2.

The upper end of the pawl 270, when the trigger is in normal position, Fig. 2, engages the lower end of a downwardly projecting tooth 274 provided upon the rear end of the sear 276, which is pivoted intermediate its ends upon a pin 278 mounted in the lateral walls of the trigger mechanism casing 256, and the other end of which is provided with the upwardly projecting tooth 280. The end of the sear carrying the tooth 280 is normally maintained in raised position by a spring 282, the upper end of which is received in a recess provided in the under side of that end of the sear while the other

end of said spring bears against the bottom wall of the trigger mechanism casing 256. A stop 284 on the forward end of the sear is adapted to engage the inwardly projecting flange 286 of the trigger mechanism casing 256 and thus limit the upward movement of the sear.

From the construction described it will be apparent that if the trigger 252 be pulled the pawl 270 acting upon the tooth 274 upon the rear end of the sear will first raise the rear end of the sear, thus lowering the front end thereof against the action of the spring 282. In the continued rearward movement of the trigger said pawl will slide by the tooth 274, the spring 272 yielding, and will thus release the rear end of the sear so that the front end thereof bearing the tooth 280 will be immediately raised again into the position shown in Fig. 14, by the spring 282. It will thus be seen that when the trigger is pulled it will operate the sear to fire the rifle and that the sear will then immediately be returned to operative position, whether the trigger be released or not.

When the trigger is released, the spring 262 will immediately return it to its normal position, Fig. 2, the spring 272 yielding to allow the pawl 270 to pass by the tooth 274 upon the sear, for that purpose.

The piston 132 is provided with means to cooperate with the sear 276. Said means may be of any suitable construction, but in accordance with the present invention it comprises a lug or member 288, Fig. 2, which is pivotally mounted within the hollow piston upon a pin 290 secured in the walls of the latter. Said lug is provided with a tooth 292 which projects out of said piston through an opening provided in the wall of the latter, a spring 294, the ends of which have bearing respectively upon the inner wall of said piston and upon said lug yieldingly maintaining said lug in that position, wherein it can be engaged by the sear 276.

The present invention contemplates the provision of means intended to cooperate with said piston, more particularly when the arm is to be operated semi-automatically, said means being herein exemplified by what may be conveniently termed a second or rear sear 296 pivoted at 298, Figs. 1 and 10, in ears 300 projecting from the side of the receiver. At its front end this sear 296 is provided with a tooth 302 adapted to project through an opening 304 provided in the wall of the piston casing to engage a lug 306 provided on the piston. The tooth 302 of the sear is maintained in position to be engaged by the front straight edge of the lug 306 by a spring 308 mounted in a recess provided in the rear end of said sear and bearing against the wall of the piston casing. The tooth 302 is provided with a bevelled

surface 310 and the lug 306 is provided with a bevelled surface 312, so that when said piston 132 is driven rearwardly, said lug 306 can pass by the tooth 302, the latter yielding against the spring 308. A lip 314 upon the forward end of the sear limits the inward movement of the tooth 302, and it will be noted that the sear 296 is located upon the outside of the casing and that the only opening is that through which the tooth 302 projects, which opening is completely closed by the lip 314 and edge of the sear projecting over the edges of said opening, so that dirt, dust and other foreign matter is prevented from entering the gun through said opening. At its rear end the sear 296 is provided with a cam surface 316, with which the handle 20 of the pin 16, previously described, is adapted to cooperate when said handle is thrown forward in a clockwise direction from its position shown in Fig. 1, to move the rear end of the sear 296 inwardly and the tooth 302 outwardly, thus withdrawing the latter from the path of movement of the lug 306 on the piston 132.

Referring more particularly to Figs. 6 and 18, means is provided for manually cocking the arm, said means herein comprising a cocking handle 318 carried by a slide 320 adapted to slide in a guideway 322 provided in the outer face of the piston casing upon the side of the arm. At its front end, the slide 320 is provided with a lug 324 which projects inwardly through a slot 326 provided in the side of the stock 32, Fig. 18, and is adapted to engage a lug 328 provided upon the piston 132. It will be noted that the slot 326 is completely contained within that part of the stock that is surrounded by the guard 80, in order to guard against the entrance of dust, sand or other foreign material.

To cock the arm, the handle 318 is drawn rearwardly and the lug 324 engaging the lug 328 on the piston, the piston will also be drawn rearwardly until the lug 306 thereon is engaged by the rear sear 296. The slide 320 is now pushed forward into its normal forward position.

It is preferable that the cocking slide be maintained in its forward position when not in use and the invention contemplates the provision of means to that end. Herein said means are exemplified by a latch 329 pivoted at 330 in a recess provided in the handle 318, Fig. 18. The latch is provided adjacent its pivoted end with two laterally projecting flanges 332, 332, which, when the latch 329 is pressed into the recess in the handle 318 extend parallel or in alignment with the slide 320, so that the handle 318 and slide can be drawn rearwardly, said flanges sliding in the guideway 322. At that part of the guideway where the handle 318 stops when the slide 321 is pushed forward, the

flanges 334 of the guideway 322 are cut away upon either side of the handle 318 for a distance a little greater than the length of the flanges 332, as shown at 336, 336, thus forming shoulders 338. If, therefore, the latch 329 be allowed to swing outwardly, as shown in Fig. 18, the ends of the flanges 332, 332 will be in alignment with the shoulders 338, 338 on the flanges 334 and thus prevent movement of the cocking handle 318 and its slide. In grasping the handle 318 to draw the slide 320 rearwardly and cock the piece, the latch 329 will naturally be pressed into the handle 318, thus releasing the ends of the flanges 332 from the shoulders 338, so that rearward movement of the slide is permitted.

The invention contemplates the provision of means to assure that the ejection opening shall be opened before the arm can be fired. One embodiment of this feature of the invention is shown in Figures 1 and 6 in which the cover plate 224 for the loading opening in the receiver is shown as provided upon one side with a downwardly extending arm 340 having its free end inturned, so that when said cover plate is closed and the slide 234 is in operative position to close the ejection opening 190, said inturned end of the arm 340 will engage a slot 342 in the slide 234. It will thus be seen that it will be impossible to raise the cover plate 224 in order to load the gun or place a magazine in place therein, without first drawing back the slide 234 and uncovering the ejection opening.

Another embodiment of this feature of the invention is shown in Figs. 16 and 17. Therein the cocking handle 318 is provided with an upwardly projecting lug 344 adapted to engage a downwardly projecting lug 346 on the lower edge of the slide 234, so that when said cocking handle is drawn backwardly to cock the piece, the slide 234 will also be drawn rearwardly and thus uncover the ejection opening.

The invention also contemplates the provision of a safety device or catch to prevent accidental discharge of the arm when it is being carried cocked. Referring more particularly to Fig. 23, said means in the embodiment of the invention herein illustrated, comprises a stud 348, see also Fig. 19, mounted for rotary movement in the side walls of the receiver and extending transversely of the latter, the axis of said stud being substantially on a level with the lower edge of the piston 132. Said stud is cut away substantially throughout half its thickness, and normally the flat surface 349 thus produced extends immediately beneath the piston 132. The piston is provided upon its under side with a notch 350 and when the arm is cocked, that is to say, when the tooth 292 is in position to be engaged by the sear 276, this notch 350 is located above

the stud 348, and if the latter be turned by means of its handle 352 into the position shown in Fig. 23, the stud 348 will engage the notch 350 in the piston and the flat surface 349 will abut against the vertical surface 354 of said notch and lock the piston against forward movement, thus preventing discharge of the arm until the stud 348 has been turned back into the position shown in Figs. 2 and 19. Preferably the construction would be such that when the stud 348 is turned to lock the piston against forward movement, the flat surface 349 of said stud will meet the surface 354 of the notch in the piston before said stud is completely turned into locking position, so that when the stud is turned the distance desired, herein 90°, it will have moved the piston slightly backward, enough to move the tooth 292 in the lug 288 slightly out of contact with the sear substantially as shown in Fig. 23. The reason for this is that if, when the piston is locked by the safety device described, the tooth 292 remained in engagement with the sear, said tooth and sear might through jostling, become disengaged from each other, and if the safety device were released while they were in that relation, the arm will be discharged. If, on the other hand, when the safety device is in operation, the tooth 292 and sear 276 are held slightly out of contact, on the safety device being released, this will allow the piston to move slightly forward, thus bringing the tooth 292 gently into engagement with the sear and the piston will be securely held against forward movement until the trigger is pulled.

I will now describe the operation of the embodiment of the invention illustrated when used as a single loader or semi-automatic arm.

Assuming the arm to be uncocked and the piston therefor and breech block to be in their forward position, as shown in Fig. 2, the safety device 348 will naturally be in its inoperative position. The rifleman now draws the slide 234 rearwardly to uncover the ejection opening 190 and then throws back the cover plate 224 to uncover the opening in the top of the receiver through which the cartridges are introduced. Should the rifleman forget to withdraw the slide 234 before throwing back the cover plate 224, he will find it impossible to operate the cover plate, owing to the engagement of the arm 340 on the latter with the slot 342 of the slide 234 and will thus be obliged to withdraw the slide 234 first.

The rifleman now cocks the rifle by seizing the cocking handle 318 and drawing it rearwardly as far as it will go, thus drawing the piston 132 rearwardly against the action of the spring 158 until the lug 306 on said piston has overrun the tooth 302 of the

rear sear 296. He then pushes the cocking handle forward as far as it will go into its normal position where it will be automatically held against movement by the locking device 332, the piston and breech block being held in their retracted position by engagement of the lug 306 upon said piston with the tooth 302 of the rear sear 296.

If the rifleman has neglected to retract the slide 234 that covers the ejection opening 190, or has only partly retracted said slide, the rearward movement above referred to of the cocking handle to cock the arm will, by the engagement of the lug 344 on said cocking handle with the lug 346 upon said slide, completely retract the latter.

When the piston 132 is moved rearwardly as above described, the breech block is also retracted as above stated, but the rearward movement of the breech block does not begin until the piston has completed approximately one-third of its rearward stroke. During the first part of the rearward movement of the piston, the block 166 with its firing pin 164 moves rearwardly with the piston relatively to the breech block which latter is held against rearward movement by engagement of its locking lug 124 with the recess 126 in the top wall of the receiver, see Figs. 2 and 11. When, however, in this rearward movement of the block 166 the cam lugs 170, 170 enter the upwardly inclined rear portions of the guideways 172 in the rear part of the breech block, said lugs acting upon the lower edges of said guideways will cause the rear part of the breech block to swing downwardly about its pivotal connection with the breech block head, thus disengaging said locking lug 124 from the recess 126, whereupon in the continued rearward movement of the piston and block 166, the breech block will also be retracted until its rear end rests substantially against the buffer 180, and will be held in this position by engagement of the lug 306 upon the piston with the sear 296.

The breech or loading chamber is now open and the rifleman places a cartridge therein in advance of the breech block. He then swings the lever 20 from the position shown in Fig. 1 forward in a clockwise direction, thus causing said lever to act upon the cam surface 316 upon the rear end of the sear 296, whereby said rear end will be pressed inwardly and the front end of the sear will be moved outwardly. The sear will thus free the lug 306 upon the piston and the latter will be moved forwardly by the spring 158 until the tooth 292 of the member 288 carried by the piston engages the tooth 280 of the sear 276, thus arresting the forward movement of the piston. Or to cause the sear thus to free the lug 306, he may simply press on the button 307, and then immedi-

ately release it. The rifleman then returns the lever 20 to its normal position in Fig. 1 to allow the rear sear to return to operative position shown in Fig. 10, ready to engage the lug 306 again on the next rearward movement of the piston. In this forward movement of the piston the bevelled upper forward corners 178 of the lugs 170, by their engagement with the shoulders 176 at the upper ends of the guideways 172 in the rear part of the breech block move the breech block forward until the latter having pushed the cartridge ahead of it into the cartridge chamber closes the latter. During the first part of this movement the rear end of the breech block is held against upward movement to free the lugs 170 from engagement with said shoulders 176, by the sliding engagement of the locking lug 124 on the rear end of the breech block with the top wall of the receiver chamber, but when the head of the breech block abuts against the front wall of the loading chamber and is arrested, thus completely closing the breech, the lug 124 on the rear end of the breech block will be under the recess 126 in the top wall of the receiver, and being thus no longer held from upward movement the rear end of the breech block will be swung upwardly by engagement of the rounded corners 178 of the lugs 170 with the shoulders 176, 176 and upper edge of the slots 172 as the piston continues its forward movement until arrested by engagement of the lug 288 thereon with the sear 276. The breech block being now locked against rearward movement by engagement of the lug 124 in the recess 126 the gun is ready to fire, which is done by pulling the trigger 252 which withdraws the sear 276 from engagement with the lug 288, whereupon the piston is driven forward the remainder of its course to cause the firing pin to explode the cartridge. Upon the explosion of the cartridge, a portion of the gases act upon the piston as described in the course of the specification and drive the latter with the breech block rearwardly until the lug 306 on the piston engages behind the rear sear 296 in preparation for the next shot. In this operation the extractor and ejector are operated to extract and eject the exploded shell, as above described in the course of the specification. The rifleman can now drop in another cartridge and go through the same operations to fire another shot, and so on indefinitely.

It will be apparent to those skilled in the art that when using the gun as above described for semi-automatic firing, the rifleman can use a magazine if he prefers instead of loading by hand.

In using the arm for automatic firing the operation is practically the same as in the case of semi-automatic firing, except that a magazine is always used and that the rear

sear is not made use of. The rifleman puts a loaded magazine in place in the rifle and throws the lever 20 forward in a clockwise direction in Fig. 1 to withdraw the tooth 302 on the sear 296 from the path of movement of the lug 306 on the piston and leaves the lever in its forward position to retain said sear in its inoperative position during the continuance of the automatic firing. In this way each time that the piston is driven back by the explosion it will be arrested in its retracted position by engagement of the lug 288 with the sear 276 instead of by engagement of the lug 306 of the piston with the sear 296 and it is only necessary to pull the trigger to fire the arm. The operation of the piston, breech block, extractor and ejector is the same as above described in the case of semi-automatic firing, except of course that the cartridges are loaded successively from the magazine instead of by hand.

It will be noted that the lug 288 upon the piston and which cooperates with the sear 276 is arranged so as to yield upon impact with said sear, owing to the presence of the spring 294, said impact being thus cushioned to eliminate as much as possible all shock of such impact, and any possibility of breakage of parts. This is an important feature and a great advantage, as the piston is necessarily driven forward with considerable force by the spring 158.

Rifles constructed in accordance with my invention possess many advantages over those heretofore used. They are light and at the same time sufficiently strong in all their parts successfully to withstand the hardest usage. They are simple in construction, comprising a relatively small number of parts, and are very simple and extremely efficient in operation. They are practically dust and dirt proof, owing to the precautions taken to close all openings through which dirt, sand or other foreign matter might enter. Other advantages have been pointed out in the course of the description and it will be apparent to those skilled in the art that my invention offers advantages other than those specifically set forth.

It will be apparent to those skilled in the art that it is not indispensable that all of the features of the invention be used conjointly, since they may be used to advantage separately in various combinations and sub-combinations. It is also to be understood that while the invention is herein described as embodied in the details illustrated, the invention is not to be considered as circumscribed by or limited to these details or any of them, but that the said details may be variously modified within the true scope of the invention which is definitely set forth by the claims.

Claims:

1. In a gun operable as an automatic or

- semi-automatic gun, in combination, a receiver, a sear normally in operative position, a trigger, intermediate connections between said sear and said trigger whereby
 5 said sear will be moved from operative into inoperative position when said trigger is pulled and then will be automatically returned into operative position, a second sear movable upon a vertical pivot upon one wall
 10 of said receiver and normally in operative position to cooperate with said trigger-operated sear in semi-automatic firing, and means to render said second sear inoperative in automatic firing.
- 15 2. In a gun operable as an automatic or semi-automatic gun, in combination, a trigger-operated sear for use both in automatic and in semi-automatic firing, a second sear vertically pivoted at a point intermediate its
 20 ends, for use in semi-automatic firing only, and having a tooth at one end and a cam surface at the other, a spring to move the toothed end of said sear into operative position, and a rotary member having a handle
 25 provided with means to act upon said cam to move the toothed end of said sear into inoperative position.
3. In an automatic and semi-automatic firearm, in combination, a receiver; a trigger-operated sear for use in automatic and
 30 semiautomatic firing; a butt; a rotary pin for connecting said receiver and butt; a handle upon one end of said pin; a second sear to cooperate with said trigger-operated
 35 sear in semi-automatic firing; means normally to maintain said sear in operative position; and a cam surface upon said sear with which the handle of said pin cooperates when turned in one direction, to withdraw
 40 said sear from operative position.
4. In an automatic rifle, in combination, a piston; a cocking lug pivoted to said piston; a trigger-operated sear to cooperate
 45 within said piston and acting upon said cocking lug thereby to relieve the shock of impact thereof with said sear.
5. In a firearm, in combination, a firing pin; means to actuate said firing pin; a
 50 spring-pressure cocking lug carried by said firing pin actuating means; a trigger-operated sear to cooperate with said cocking lug; and locking means to lock said actuating means in cocked position against
 55 movement to actuate the firing pin and with said cocking lug out of contact with said sear whereby to relieve the pressure upon said spring-pressed cocking lug and upon said sear.
- 60 6. In a machine gun or automatic rifle, in combination, firing mechanism, an actuator therefor having a spring-pressed cocking lug and provided with a notch, a sear adapted to engage said lug, a rotary locking
 65 member provided with a handle for rotating said member in one direction to cause it to engage said notch and lock the actuator in cocked position but with said lug slightly out of contact with said sear, and for rotating it in the opposite direction to withdraw
 70 said member from said notch to release the actuator.
7. In a machine gun or automatic or semi-automatic rifle, in combination, breech
 75 mechanism including a firing pin, an actuator for said breech mechanism, a casing enclosing said actuator and provided with a longitudinal slot, a slide movable
 80 upon said casing and having a lug projecting through said slot and adapted to cooperate with said actuator to cock the gun or rifle, means including a hand guard to close said slot against the entrance of
 85 foreign material, a cocking handle carried by said slide, and locking means carried by said handle for locking said slide against movement when not in use.
8. In a machine gun or automatic rifle, in combination, a receiver; breech mechanism therein; an opening provided in said receiver and through which the exploded cartridges are ejected; a cover movable independently of said breech mechanism to cover
 90 and uncover said opening; and means to assure movement of said cover to uncover said opening before said arm can be loaded.
9. In a machine gun or automatic or semi-automatic rifle, in combination, a receiver; an opening provided in said receiver through
 95 which to introduce the cartridge or to receive a magazine; a removable cover for said opening; a discharge opening for the exploded cartridges; a movable cover therefor; and means whereby movement of said first-named cover is controlled by the last-
 100 named cover.
10. In a machine gun or automatic rifle, in combination, a receiver; an opening provided in said receiver through which to introduce the cartridges or to receive a magazine; a cover movable to and from position
 105 to close said opening; a second opening provided in said receiver through which the exploded cartridge-shells are ejected; a cover movable to and from position to close said second opening; and means intermediate
 110 said two covers, whereby said second cover must be withdrawn from its opening before the first-named cover can be withdrawn from its opening.
11. In a machine gun or automatic rifle, in combination, a receiver; operating mechanism therein; an opening provided in said receiver through which the exploded cartridge-shells are ejected; a cover movable
 115 to and from position to close said opening; a piston to actuate said operating mechanism; means to move said piston to cock the arm; and means intermediate said cover and said piston whereby movement of the latter

to cock the arm will move said cover to uncover said opening, said cover being movable independently of said piston to uncover said opening.

- 5 12. In a rifle, in combination, a receiver; a butt; a sear movable from operative to inoperative position; movable means con-

necting said butt and receiver; and means whereby movement of said butt and receiver connecting means will move said sear from operative to inoperative position. 10

In testimony whereof, I have signed my name to this specification.

ANDRÉ VIRGILE PAUL MARIE BERTHIER.